SP-155035
(New)

SPECIAL PROVISIONS
FOR
WATER MAIN

Muscatine County
STBG-SWAP-5330(627)--SG-70

Effective Date
March 16, 2021

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 – DESCRIPTION

1.01 SUMMARY

This Special Provision covers construction, connections, and repairs made on Muscatine Power and Water's (MPW) water distribution system.

1.02 CODES AND STANDARDS

A. In the event of a conflict between codes and standards, the one establishing the more stringent requirements shall be followed.

B. The following standards and specifications are used in or referred to in these specifications:

1. 10 States Standards (above all for fire flow and design).
2. City of Muscatine, Iowa, Codes and Standards.
3. Muscatine Power and Water's rules and regulations as outlined in WATER CUSTOMER SERVICE HANDBOOK.
4. Muscatine Power and Water's current "Backflow Prevention Policy".

C. The most current versions or updates of the above specifications are to be used unless otherwise noted in the contract documents.

D. Copies of all codes and standards referenced in these specifications are on file for review at the offices of Muscatine Power and Water, 3205 Cedar Street, Muscatine, Iowa 52761.

1.03 SUBMITTALS

A. All shop drawing submittals shall include a standard transmittal form.

B. Shop drawing submittals shall include one electronic in PDF and one hard copy of all submittal items required in the contract documents.

C. Contractor shall submit manufacturer's catalog data for all items to be used in constructing the Project, one electronic Adobe .pdf file and one hard copy

D. Contractor shall submit certificates from manufacturers evidencing compliance with standards listed in these specifications and as listed in the contract documents.

PART 2 – MATERIAL

2.01 PRODUCTS

A. Ductile iron water main pipe (DIP) shall conform to AWWA C151. Pipe shall be cement-mortar lined in accordance with AWWA C104. Thickness design of pipe shall conform to AWWA C150. Pipe shall be manufactured with a bituminous coal tar base exterior coating system not less than 1 mil thick in accordance with AWWA C151. Nitrile gaskets shall be provided for water main construction unless noted and approved by MPW. No exceptions are allowed where it is determined that hydrocarbon contamination is present. All pipe and pipe joints shall be push-on, restrained or mechanical as required by the design and shall conform to AWWA C111 unless otherwise designed and approved by MPW. Pipe shall be minimum Class 52 unless specified otherwise on the plans or contract documents.

B. Polyvinyl Chloride Pipe (PVC) shall be manufactured in accordance with AWWA C900. Pipe joints shall be bell-and-spigot, push-on type with integral elastomeric gasket, in conformance with ASTM D 3139 and ASTM F 477. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign material blisters, and other visible deleterious faults. Pipe shall be manufactured from rigid polyvinyl chloride compound with cell classification 12454-B as defined in ASTM D 1784. Normal laying length is 20 feet. PVC pipe shall not be permitted in identified Leaking Underground Storage Tank (LUST) sites where possible hydrocarbon contamination may occur.

C. Restrained Joint Polyvinyl Chloride Pipe (RJ-PVC) shall be manufactured in accordance with AWWA C900. Pipe joints shall be non-metallic mechanically restrained elastomeric bell-and-spigot joints of either coupled or integral bell type in conformance with ASTM F 477 and AWWA C-900. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign material blisters, and other visible deleterious faults. Pipe shall be manufactured from rigid polyvinyl chloride compound with cell classification 12454-B as defined in ASTM D 1784. Normal laying length is 20 feet. RJ-PVC pipe shall not be permitted in identified LUST sites where possible hydrocarbon contamination may occur.

D. High Density Polyethylene water main pipe (HDPE) and fittings shall conform to AWWA C906. Any deviations in material or workmanship including fusing shall be rejected if it does not conform with AWWA C906. HDPE pipe shall be ductile iron pipe size with black with two blue stripes. Wall thickness shall be DR11 unless specified differently on the plans. HPDE pipe will be permitted on a case-by-case basis as shown as approved by MPW. HDPE shall not be permitted in identified LUST sites where possible hydrocarbon contamination may occur.

E. Mechanical Joint Restrained shall be EBAA IRON INC. 1100, 1100SD, or 1100HD Series MEGALUG Mechanical Joint Restraints or equal.

F. Tie rods shall be no less than 3/4 inch diameter threaded steel coated with two coats of coal tar epoxy paint or approved spray on bituminous automotive undercoating material.

G. Ductile iron fittings shall conform to AWWA C110 (full-body) and AWWA C153 (compacts). Fittings shall be cement-mortar lined in accordance with AWWA C104. For pipes smaller than 4 inches fittings shall be push-on. For pipes with a nominal diameter 4 inches and larger fittings shall be mechanical joint (MJ) or as specified by the plans. Bolts, nuts and washers shall be

stainless steel or high strength low alloy Corten Blue. HDPE pipe fittings for new construction shall conform to AWWA C906 and be heat fused.

H. Gate valves shall conform to AWWA C509. Acceptable manufacturers are Mueller, American Flow Control, or East Jordan. Gate valves shall meet the following specific requirements: Resilient seated wedge type. Manufacturer Tested to 500 psig, 250 psig working pressure, turn clockwise (right) to open, epoxy coated (triple dipped). Stainless steel bolts in the bonnet, bi-directional flows and flat bottom for handling, brass trim, triple O-ring seal on stem and O-ring seal on bonnet with the top two replacements with valve open, non-rising stem with 2 inch square wrench nut with notification washers made from polymer, all bolts to be stainless steel.

I. Butterfly valves shall only be used in special circumstances and shall conform to AWWA C504. Butterfly valves shall meet the following specific requirements: Steel adjusting packing, stainless shaft. stem with 2 inch square wrench nut, turn clockwise (right) to open, epoxy coated, all bolts to be stainless steel, domestic preferred.

J. Tapping valves shall be MJ x MJ gate valves.

K. Tapping sleeves for ductile iron or PVC water main pipe taps shall be all stainless steel per ASTM A 240, fully enclosed tapping sleeve, full wrap gasket, full flange, and stainless steel bolts and nuts with 3/4 inch NPT test plug with stainless plug. Approved tapping sleeve styles include JCM-432, Ford-FTSS, Mueller-H-304 or approved equal with nitrile gasket.

L. Valve boxes shall be domestic only, heavy duty, with centering ring. Cover shall have the word "WATER" cast into the cover. Provide 5 foot standard length unless specified otherwise. Bury depths greater than 5 feet need a valve nut extender.

M. Valve box extension stems shall be provided for buried valves when the operating nut is more than 5 feet 6 inches below finished grade. Each extension stem for a buried valve shall extend to between 5 feet and 5 feet 6 inches of the ground surface, no exceptions will be allowed, and shall be provided with spacers, which sill center the stem in the valve box, and shall be equipped with a 2 inch wrench nut painted red.

N. Fire hydrants shall conform to AWWA C502. All hydrants shall be Mueller Centurion, Waterous Pacer, or East Jordan meeting the following specific requirements: 6 inch mechanical joint connection, direction to open shall be clockwise (right), nozzles: two 2 1/2 inch hose nozzles, one 4 1/2 inch pumper nozzle, nozzles to be National Standard Thread (NST) style, O-ring packing nitrile, suitable for 5 foot depth of cover unless specified otherwise on Plans. Valve opening of 4 1/2 inch, automatic drain valve to drain hydrant barrel when main valve is closed. Operating nut shall be National Standard 1 inch square, oversized mechanical joint shoe, epoxy coated bowl. All underground parts shall be constructed of ductile iron with Stainless steel bolts. Shall include 1 inch washed rock around the drips in the hydrant. Exposed hydrant body shall be factory primed painted white and buried portion shall have top coats black.

O. Tracer wire components for water main pipe shall be Copperhead brand, blue polyethylene jacketed.

    1. Open-Cut Installation: Copperhead brand, blue, SuperFlex.
    2. Horizontal Directional Drill Installation: Copperhead brand, blue, SoloShot.
    3. Tracer wire splices shall be Copperhead Industries LLC tracer wire. Dry-con connectors – 3WB-01-Blue, three-way direct bury lug connector. Snake Pit Trace Wire Boxes – RP14*TP for roadway, LD14*TP – Adjustable for light duty. Copperhead 1 pound magnesium anode used on dead-end trace wires. Cobra Test Station for service ends, T3-B75, Blue.

P. Polyethylene pipe wrap shall be installed on all ductile iron pipe, fittings and buried hydrant barrels. Polyethylene pipe wrap shall conform to AWWA C105. The ploy-wrap shall be secured around the pipe with 2 inch wide by 10 mil thick tape supplied by the poly-wrap manufacturer.

Q. Water service piping shall have a minimum 1 inch nominal diameter from the main to the service meter. During water main replacement projects all services shall be replaced to the meter setter with approved pipe material if the existing service line is not approved service line material. Service lines 2 inches in diameter and smaller, but no less than 1 inch shall be Type K (heavy), soft annealed, seamless copper. Connections to existing service lines (where required) shall be three-piece compression type, Mueller 110 Conductive Compression Connection. If the main is wrapped with poly-wrap, so should service for 3 to 4 feet.

R. Service tapping saddles 1 1/2 inch and 2 inch for tapping ductile iron or cast iron pipe for shall be JCM 406, ROMAC Style 202NS, Smith Blair 317, Mueller DR2S or Ford FC202 service saddles, nylon or thick epoxy coated with stainless steel straps for use on ductile iron or cast iron pipe. Torque to manufacturer's specifications.

S. Corporation and curb stops shall be as follows:

   1. Corporation: Mueller No. B-25008, 1 inch lead free brass.
   2. Curb Stops: Lead free brass Mueller H-10314 curb stop box and valve with 5 foot long curb box, extension type – arch pattern base, one piece lid with rod, upper section lid to be two hole.

T. Backflow prevention devices shall conform to requirements of MPW's current "Backflow Prevention Policy" and MPW's current "Customer Service Handbook". Check with MPW's Metering Department for latest updates of both documents.

PART 3 - CONSTRUCTION

3.01 INSPECTION AND TESTING

A. Construction will be inspected by MPW representative. No pipe or appurtenances shall be buried prior to final approval by MPW representative.

B. In place trench compaction testing will be done in accordance with Article 2552.03, F of the Standard Specifications.

C. One set of four concrete test cylinders shall be taken for each concrete pour. Cylinders will be retained by MPW and broken if a question arises as to the strength of the concrete provided. Each cylinder shall be provided with a tag giving the date, time, location and strength requirements specified for the Project. Tag to be taped to each cylinder with several wraps of fiber packing tape.

D. All pipe and appurtenances are subject to inspection by MPW at the point of delivery. Material found to be defective due to manufacture or damaged in shipment shall be rejected or recorded on the bill of lading and removed from the job site. MPW may perform tests as specified in the applicable AWWA standard to ensure conformance with the standard. In case of failure of the pipe or appurtenance to comply with such specifications, responsibility for replacement of the defective materials becomes that of the Contractor.

E. Pipe and appurtenances to be tested shall be filled slowly with potable water. After filling, lines shall be flushed at blow-offs and dead-ends at a minimum velocity of 3.0 feet per second in the pipeline to be tested (refer to AWWA C651 Table 3 for required flow and openings). Flushing shall be carried out until turbidity-free (< 5 NTU or system ambient values) water is obtained from all points along the main. Certain contaminants resist flushing at any feasible velocity and pigging

of the main may be required. A special pipeline pig may be required when the required flushing velocity cannot be achieved or when needed to conserve water during water use restriction period or to remove cake deposits or to prevent erosion damage, nuisance or traffic interruption, as directed by the Engineer.

F. Pressure test after initial flushing of line and before bacteriological testing has commenced. An MPW representative shall be present at the beginning and end of each pressure test. MPW shall be notified of the time of the test a minimum of 24 hours prior to the test. MPW representative shall record the test pressure at 30 minute intervals. The duration of the pressure test shall be a minimum of two hours and cannot commence until the MPW representative records the initial test pressure. The pipeline shall be allowed to stabilize at the test pressure before conducting the hydrostatic test.

Pressure testing shall be conducted through MPW installed corporations and not through fire hydrants.

CAUTION: Pressurize HDPE pipe in accordance with manufacturer's recommendations. Pressurizing HDPE pipe for testing or placing into service requires additional precautions: Leaks at pressurized fusion joints may immediately precede catastrophic and sudden pipe separation and result in violent and dangerous movement of piping or attached parts and cause a sudden release of piping contents under pressure. Never approach or attempt to repair or stop leaks while pipe is pressurized. Always depressurize pipe before making corrections. Faulty fusion joints cannot be repaired. They must be cut out and rejoined using proper heat fusion procedures.

1. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. After all the air has been expelled, all corporation cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as directed by MPW representative.
2. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered during the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until line passes test to MPW's satisfaction.
3. All make up water and make up water containers and pumps shall be cleaned and disinfected with a 6% to 8% chlorine bleach solution.
4. When hydrants are in the test section, the test shall be made against the auxiliary valves of the hydrant.
5. The contractor may be responsible for disinfection of the water main on a case by case basis.

The pressure test shall consist of holding a minimum hydrostatic pressure of 150 psi for a period of 2 hours at the lowest elevation of the test section. Test pressure shall not exceed pipe, thrust-restraint, or appurtenances' design pressure at the lowest section of pipeline being tested.

Water mains shall be pressure tested at valved sections, not exceeding 1200 feet in total length. Valves shall not be operated in either direction at differential pressures exceeding the rated valve working pressure.

A 2 pound test gauge with a minimum capacity of 160 pounds shall be required. The test shall conform to the applicable sections of AWWA C600, AWWA C605 or AWWA C906. The hydrostatic test pressure shall not vary by more than +/- 5.0 psig for the duration of the test period. The test pressure shall be maintained within this tolerance by adding make-up water

through a metered pressure test pump into the pipeline test segment. The meter on the pressure test pump shall be capable of reading to the nearest 0.10 gallon increment. All make-up water added shall be accurately measured in gallons (and fractions thereof) by suitable methods. The total make-up water added during and at the conclusion of the test period to reach the required test pressure shall not exceed the calculated leakage allowance for the pipeline segment being hydrostatically test as outlined in sections AWWA C600, AWWA C605 or ASTM F 2164.

G. Tracer wires will be tested by MPW representative for continuity shortly after pressure testing has been completed.

H. Disinfection shall conform to AWWA C651 excluding the use of calcium hypochlorite granular tablets. Preferred disinfection method is the continuous-feed method for new waterline construction.

I. Bacteriological Testing: MPW will take two bacteriological samples 24 hours apart for in-house analysis after disinfection for each sample location as required in AWWA C651. Contractor shall assist MPW in collecting samples as required. MPW will not place installation into operation until test results from water samples taken test out satisfactory. One set of bacteriological tests shall be collected from every 1200 foot section of new water main, plus one set from the end of the line and at least one set from each branch.

A more specific description of the process follows:

Once the pipe section has been slowly filled, the bacterial/disinfection test will be officially started. The test requires the pipe to stand for 24 hours undisturbed after the initial chlorination testing confirms that a minimum of 25 ppm available chlorine is present when using the continuous-feed method. If less than 25 ppm of chlorine is available at initial filling, the test will be considered invalid and pipe must be rechlorinated. After 24 hours the residual will be checked to confirm that not less than 10 ppm of chlorine is available. If confirmed, the pipe can be flushed until the available chlorine is equal to the normal distribution levels and a sample for analysis will be drawn. The pipe shall be isolated again for 24 hours. After 24 hours, the water will be tested a second time to confirm not less than 0.3 ppm of chlorine remains in the main. If confirmed a second sample will be drawn for bacteriological analysis. Failure of any of the above test results will require re-chlorination to the minimum 25 ppm and repeat bacteria testing. All chlorinated water needs to be de-chlorinated by an approved method before it is released to the environment.

The contractor may be responsible for de-chlorination of the water main from high test chlorination on a case by case basis.

For any failed bacteria test, the IDNR must be notified by MPW lab staff.

All pressure testing and bacteriological tests shall be completed prior to the installation of service lines.

3.02 LOCATING BURIED UTILITIES

A. Contractor shall contact the Iowa One-Call system at 1-800-292-8989 for locations prior to doing any excavating (48 hour notice required).

B. All utility crossing shall be exposed by pot-holing or day-lighting prior to crossing with underground drilling equipment, HDD, moles, etc.

3.03 PROTECTION OF EXISTING FACILITIES

A. Contractor shall exercise care to assure that all private and publicly owned facilities, buildings, poles, wires, walkways, roadways, and other items near the construction area and not shown as removal items on the Plans are protected so they are not damaged or destroyed.

B. Contractor shall repair or replace all damaged items.

3.04 WORK BY MPW AND COORDINATION WITH MPW

A. Contractor shall coordinate activities with MPW so that disturbances to normal utility water system operations are minimized. Contractor shall provide a minimum 24 hour notice to MPW to allow adequate scheduling of men and equipment. Contractor shall assume all responsibilities for costs incurred due to the lack of 24 hour notice to MPW. MPW must be notified at least 3 working days before a scheduled water outage to allow time for customer notification.

B. Operation of all valves and hydrants during charging of main, pressure testing, disinfection and bacteria testing shall be by MPW unless specifically directs otherwise.

C. MPW will hold electrical poles where necessary for construction if construction is within the MPW'S electrical service area. Contractor shall provide a minimum 24 hour notice to MPW to allow adequate scheduling of men and equipment. On projects contracted by Muscatine Power and Water there will be no charge to Contractor for this service. On all other projects, Contractor will be billed for this service. Contractor shall be responsible for the coordination and fees charged by utilities for this service outside MPW's electrical service area.

3.05 TRENCH EXCAVATION

A. Trench excavations shall be in compliance with 29 CFR Part 1926 OCCUPATIONAL SAFETY AND HEALTH STANDARDS-EXCAVATIONS.

B. Sheeting, shoring, bracing, and trench boxes shall be of an OSHA approved design and certified in accordance with current OSHA rules and regulations. Sheeting and shoring materials shall be removed in a manner that avoids damage or disturbance to the work completed or adjacent structures or pavements. Trench boxes shall be lifted prior to moving forward to prevent displacement of pipe in place.

C. Compact light weight trench boxes or shoring shall be required in front yard stop box replacements for contractor's safety and to minimize disturbances to lawn, sidewalk and parking areas.

D. Excavation depth to provide a minimum 5 foot cover over top of pipe.

E. Trench width shall be ample to permit the pipe to be laid and joined properly but should be no more than 12 inches on either side of the pipe. Keep walls of trench vertical below top of pipe.

F. Level trench bottom to provide uniform bearing and support for full length of the pipe barrel. Provide bell holes for each pipe joint. Stones found in the trench shall be removed for a depth of at least 6 inches below bottom of pipe.

G. If soft, spongy, or otherwise unsuitable materials are encountered which do not provide suitable bedding or support for the pipe, Contractor shall notify MPW representative immediately.

If removal of unsuitable material is authorized, contractor is responsible for removal of material.

Contractor shall replace unsuitable materials with MPW approved crushed stone, sand or manufactured sand as appropriate. New materials shall be placed and compacted in accordance with backfill portion of these specifications.

H. All pipe installations shall be conducted only in dry materials. Contractor shall take such steps as are necessary to prevent surface and ground water from flowing into the excavation. Remove all accumulated water by pumping or dipping with equipment bucket.

I. Dewatering systems, if required, shall be subject to MPW approval and shall remain in place until construction work and testing have been completed.

3.06 BACKFILL AND COMPACTION

A. Backfill shall not proceed until water main installation, thrust blocking or thrust restraints have been inspected and approved by MPW representative.

B. Backfill materials shall be suitable soils from trench excavation or from a borrow area approved by MPW engineer. Suitable materials shall be free of debris, small stones, rock, roots, lumps, frozen materials or any other items that will prevent placing and compacting the material to the density required.

C. Backfill under or within 10 feet of the edge of roadways or parking areas shall be manufactured sand compacted in accordance with these specifications.

D. Backfill shall be placed on both sides of pipe simultaneously to prevent displacement. Place backfill in successive horizontal lifts of not more than 8 inches loose depth. This depth may be adjusted if it can be shown that required compaction can be achieved utilizing a different layer thickness. Backfill shall be placed and compacted using hand equipment up to 18 inches above top of pipe.

E. Place material at proper moisture content for obtaining specified density.

F. Compaction requirements are as follows:

    1. Areas beneath or within 10 feet of edge of roadways or parking areas shall be compacted to 95% of maximum dry density as determined by ASTM D 1557.

    2. All other areas shall be compacted to 90% of maximum dry density as determined by ASTM D 1557.

    3. Method of compaction is subject to Engineer's approval.

G. "Flooding" or "jetting" of backfill trench is not an acceptable compaction method or process and will not be approved.

3.07 PIPE AND MATERIAL HANDLING AND STORAGE

A. All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skid ways shall not be rolled or skidded against pipe on the ground.

B. Slings, hooks, or pipe tongs shall be used in such a manner as to prevent damage to the exterior surface or internal lining of the pipe.

C. Stored materials shall be kept safe from damage. The interior of all stored and placed pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times by use of tight fitting end plugs or sturdy durable plastic bags or other MPW approved means. Pipe and fittings contaminated with mud and surface water shall be removed from the site and not used in construction unless thoroughly cleaned by the Contractor and inspected and approved by MPW. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

D. Gaskets for mechanical and push-on joints shall be stored in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

E. Mechanical-joint bolts shall be handled and stored in a dry location in a manner that will ensure proper use with respect to types and sizes.

F. Staging shall not occur prior to one week of construction and placed in a neat and orderly fashion.

3.08 PIPE INSTALLATION

A. Ductile iron pipe installation shall conform to the requirements of AWWA C600. PVC pipe installation shall conform to the requirement of AWWA C605. HDPE installation shall conform to the requirement of AWWA M55.

B. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of suitable tools, rigging and equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

C. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by MPW representative, who may prescribe corrective repairs or reject the materials.

D. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign materials before the pipe is laid.

E. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.

F. As each length of pipe is placed in the trench the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material. Lay pipe in dry bedding material.

G. At all times when pipe-laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by MPW. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation, should the trench fill with water.

H. Cutting pipe for insertion of valves, fittings, or closure pieces shall be done in conformance with all safety recommendations of the manufacturer of the cutting equipment. Cutting shall be done in a safe, workmanlike manner without creating damage to the pipe or cement-mortar lining. All PPE shall be used while cutting, including safety glasses and a shield. Pipe may be cut using a hydraulic squeeze cutter, abrasive pipe saw, rotary wheel cutter or guillotine pipe saw. Cut ends and rough edges shall be ground smooth, and for push-on joint connections, the cut end shall be beveled by methods recommended by the manufacturer and approved by MPW.

I. For installations requiring polyethylene encasement for ductile iron pipe, the encasement shall be installed in accordance with AWWA C105 and recommendations of DUCTILE IRON PIPE RESEARCH ASSOCIATION INSTALLATION GUIDE FOR DUCTILE IRON PIPE. This includes overlapping and the correct tape to be used on the joints.

J. Pipe which is damaged or unsound will be rejected and marked. Sound pipe before installation to detect cracks.

K. Use suitable fittings where grades or alignments require offsets greater than manufacturer's recommended joint deflections.

L. Follow manufacturer's recommended installation and assembly practices.

M. CAUTION: Pressurizing HDPE pipe for testing or placing into service requires additional precautions: Leaks at pressurized fusion joints may immediately precede catastrophic and sudden pipe separation and result in violent and dangerous movement of piping or attached parts and cause a sudden release of piping contents under pressure. Never approach or attempt to repair or stop leaks while pipe is pressurized. Always depressurize pipe before making

corrections. Faulty fusion joints cannot be repaired. They must be cut out and rejoined using proper heat fusion procedures.

N. TRENCHLESS INSTALLATION

1. General: Select a method of installation that is appropriate for the soil conditions anticipated and will 1) allow the pipe to be installed to the desired line and grade within the specified tolerances; 2) prevent heaving or settlement of the ground surface or damage to nearby facilities; and 3) prevent damage to the carrier pipe and any lining materials within the carrier pipe.
2. Installation Method: Horizontal directional drilling (HDD) shall be the primary method for installing pipe with trenchless technology. HDD installs pipe from a surface-launched drilling rig. A pilot bore is formed and then enlarged by back reaming and removing the spoil material. The pipe is then pulled in place. Other methods may be allowed with the Engineer's approval.
3. Line and Grade: Install pipe at line and grade that will allow the carrier pipe to be installed at its true starting elevation and grade within the specified maximum alignment deviation of the pipe centerline. When no deviation tolerances are specified in the contract documents, apply the following maximum deviations to the carrier pipe.
4. Pressurized Pipe: Tolerances for installation of pressurized water main pipe shall include horizontally accuracy of ± 2.0 feet, vertical accuracy ± 1.0 foot, while maintaining the minimum depth specified in the contract documents. Greater deviation or interference with other identified facilities may be cause for rejection.
5. Deviation from Line and Grade: Installations deviating from the specified tolerances that cannot be adjusted to conform to the specified tolerances may be rejected by the Engineer. If nonconforming installation is not rejected, provide all additional fittings, manholes, or appurtenances needed to accommodate horizontal or vertical misalignment, at no additional cost to MPW. Abandon rejected installation and place special fill materials, at no additional cost to MWP. Replace abandoned installations, including all additional fittings, manholes, or appurtenances required to replace rejected installations.
6. Casing Pipe or Un-cased Carrier Pipe Installation: Install pipe by approved methods. Use a jacking collar, timbers, and other means as necessary to protect the driven end of the pipe from damage. Do not exceed the compressive or tensile strength capacity of the pipe during pushing or pulling operations. Fully support bore hole at all times to prevent collapse. Insert pipe as soil is removed, or support bore with drilling fluid. Fully weld all casing pipe joints. Use an interlocking connection system when approved by the Engineer. Fill space between the inside of the bore hole and the outside of the pipe with special fill material if the space is greater than 1 inch.
7. Pit Restoration: Remove installation equipment and unused materials from the launching and receiving pits. When the carrier pipe extends beyond the limits of trenchless installation and into the bore pit, place bedding and backfill material according to this Section. Place suitable backfill material in the pit. Apply the testing requirements of this Section. Restore the site to original condition or better.

3.09 TRACER WIRE INSTALLATION

A. Tracer wire shall be installed on top of water main once backfill has been brought up to top of pipe.

B. Tracer wires will be tested for continuity before final acceptance of the project. Wires without continuity shall be repaired or reinstalled by Contractor.

C. Tracer wire shall be brought up to ground level at all valve boxes and installed in a separate tracer wire box. At all dead ends and valve/hydrants, a tracer wire anode shall be installed.

D. Tracer wire access boxes shall be placed at a maximum distance of 500 feet.

3.10 HORIZONTAL AND VERTICAL SEPARATIONS

A. Horizontal Separation of Gravity Sewers from Water Mains:

1. Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless: (a) the top of a sewer main is at least 18 inches below the bottom of the water main, and (b) the sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.

2. When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials. However, provide a linear separation of at least 2 feet.

B. Separation of Sewer Force Mains from Water Mains: Separate sewer force mains and water mains by a horizontal distance of at least 10 feet unless:

1. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and,

2. The sewer force main is laid at least 4 linear feet from the water main.

C. Separation of Sewer and Water Main Crossovers:

1. Vertical separation of sanitary and storm sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

2. Where the sanitary sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main.

3. Where the storm sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material or reinforced concrete pipe (RCP)with flexible O-ring gasket joints so both joints are as far as possible from the water main.

D. Surface Water Crossings:

1. Above-water Crossings: Ensure the pipe is adequately supported and anchored; protected from vandalism, damage, and freezing; and accessible for repair or replacement.

2. Underwater Crossings: Provide a minimum cover of 5 feet over the pipe unless otherwise specified in the contract documents. When crossing water courses that are greater than 15 feet in width, provide the following: (a) pipe with flexible, restrained, or welded watertight joints, (b) valves at both ends of water crossings so the section can be isolated for testing or repair; ensure the valves are easily accessible and not subject to flooding,

and (c) permanent taps or other provisions to allow insertion of a small meter to determine leakage and obtain water samples on each side of the valve closest to the supply source.

E. No water pipe shall pass through or come in contact with any part of a sewer manhole, sewer, or other appurtenance. A minimum horizontal separation of 3 feet shall be maintained.

F. Should physical conditions exist such that exceptions to above separations are required, Contractor shall obtain MPW engineer's assistance for details which will provide protection equal to that provided by above items. When it is impossible to obtain the minimum specified separation distances, the IDNR must specifically approve any variance from the above requirements.

3.11 CONNECTIONS TO EXISTING WATER MAINS

A. Existing water mains shall remain in service during installation of new water main. Length of time for tie-in shall be kept to a minimum. Coordinate tie-in with MPW.

B. Uncover existing mains, to which connections are to be made, a sufficient time ahead of pipe laying operations to verify fittings required.

3.12 GATE VALVES AND FITTINGS

A. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and seating surfaces, handling damage, and cracks. Defective valves shall be corrected or held for inspection by the MPW representative. Valves shall be closed before being installed.

B. Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified for all valves for cleaning, laying, and joining pipe. Valves 12 inches and larger should be provided with special support, such as crushed stone or concrete blocks so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.

C. Install valves with stems vertical, except where shown otherwise on plans.

D. Tighten valve glands on new and existing valves as work is installed; replace O-rings if required and retighten glands after valves are placed in operation and brought up to operating pressure. Replace any O-rings which are deteriorated or in unsatisfactory condition.

E. A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve. Valve box shall be centered over the operating nut of the valve using one standard centering ring manufactured for that purpose. The box cover shall be flush with the surface of the finished area unless otherwise directed by the MPW.

F. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

G. If valves are going to be deeper than 5 feet from ground surface, MPW requires a valve nut extension. If deeper than 8 feet, a solid valve box will be required.

3.13 TAPPING VALVES AND SLEEVES

A. Conform to requirements for gate valves and fittings listed above.

B. Follow manufacturer's recommended assembly and installation practices.

C. All valves and sleeves shall be blocked for support.

3.14 FIRE HYDRANTS

A. Prior to installation, all hydrants shall be inspected for direction of opening, nozzle threading, operating-nut and cap-nut dimensions, tightness of pressure-containing bolting, cleanliness of

inlet elbow, handling damage, and cracks. Defective hydrants shall be replaced or held for inspection by the MPW representative.

B. All hydrants shall be set plumb and shall have their nozzles parallel with or at right angles to the curb, with steamer (largest) nozzle facing the curb.

C. Hydrants shall be set to the established grade and set to the bury line marked on the hydrant so the breakaway will work correctly.

D. Hydrant drains shall not be connected to, or located within 10 feet of, sanitary sewers and storm

E. All fire hydrants shall be independently valved. Refer to Contract Documents for plan layout of valving and pipe.

F. Flush hydrants shall be used at the discretion of MPW.

G. Hydrants need to be blocked with hard blocks and shims. Pour concrete only if poor soils are in the area.

3.15 THRUST RESTRAINT AND BLOCKING

A. Thrust blocking

1. Provide cast-in-placed concrete thrust blocks where buried piping changes direction, changes size, and at dead ends, unless otherwise noted on the plans.
2. Concrete shall have a minimum compressive strength of 4000 psi in 28 days. Allow concrete adequate time to reach a compressive strength of 3000 psi prior to pressure testing.
3. Concrete thrust blocks shall be cast against undisturbed vertical edge of trench for bearing. The bearing surface of thrust block shall be symmetrical vertically and horizontally with respect to line of force of pipe or joint.
4. Thrust blocks at dead ends, plugs and caps shall be removable so that lines may be easily extended after testing and a period of normal service
5. Thrust blocks at fittings shall be placed in such a manner as to permit tightening of mechanical joint bolts after placement of trust block.
6. Sizes of thrust blocks in square feet of bearing area for water mains based on soil bearing capacity of 2000 pounds per square foot are listed in the table below:

Pipe Size	90° Bend	45° Bend	22 1/2° Bend	11 1/4° Bend	Dead End or Tee
(Inches)	(Square Feet)				
4	3	2	2	1	2
6	6	3	2	1	4
8	10	5	3	2	7
10	14	8	4	2	10
12	20	11	6	3	14
14	26	14	8	4	19
16	34	19	10	5	24
18	40	22	11	6	28
20	52	28	15	7	37

7. Thrust blocking from pipe sizes greater than 20 inches will be as shown on the plans or in the contract documents.

8. Thrust blocks shall be subject to inspection and approval of the MPW representative prior to water main testing.

B. Tie rods

1. Tie rods and fittings shall be suitable for use with mechanical joint fittings.
2. Coat tie rods and fittings with two coats of coal tar paint or spray on bituminous automotive undercoating material after installation.
3. Tie-rod assemblies and systems are subject to MPW approval.

C. Thrust restraint:

1. Mechanical joint restraints for push on or mechanical joints may be used instead of concrete blocking when indicated on the plans or in the contract documents.
2. The preferred method is to use joint restraints (i.e. Megalugs) in addition to concrete blocking or poured kickers.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Method of measurement shall be according to Section 2554 of the Standard Specifications or as indicated in the Estimate Reference Information.

PART 5 - BASIS OF PAYMENT

Basis of payment shall be according to Section 2554 of the Standard Specifications or as indicated in the Estimate Reference Information.